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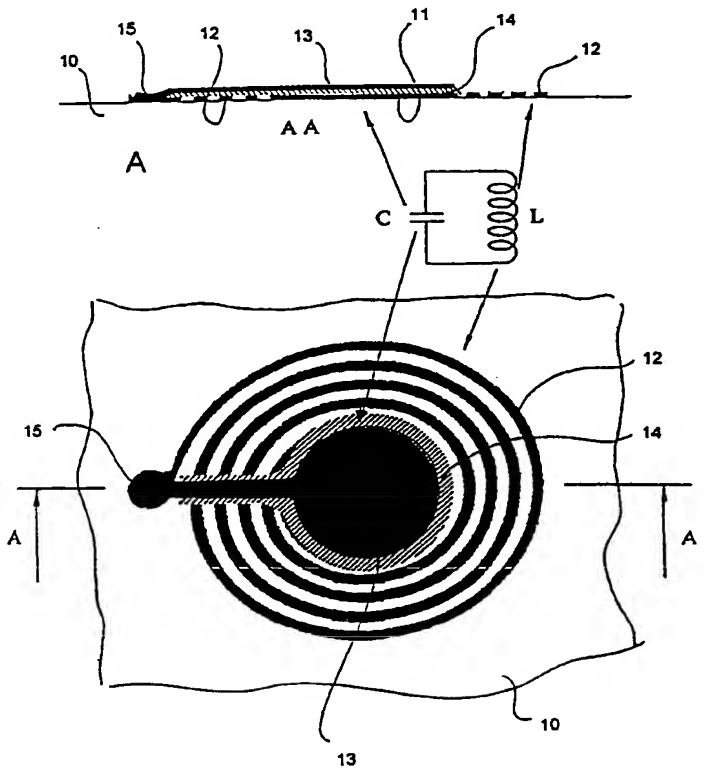
(54) Title: RADIOFREQUENCY RESONANT CIRCUIT SENSING DEVICE, METHOD OF ITS PRODUCTION, AND USES



(57) Abstract: A radiofrequency resonant circuit sensing device, a method of its production, an apparatus and sensing device comprising it; and its use for the detection of fluid levels, empty containers, and leak of fluids from containers and bodies containing said fluids; e.g. for monitoring collection of drain of fluid from a human or for monitoring leak of fluid from a human suffering from urinary and/or faecal incontinence.

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RADIOFREQUENCY RESONANT CIRCUIT SENSING DEVICE, METHOD OF ITS PRODUCTION, AND USES

DESCRIPTION

1. BACKGROUND OF THE INVENTION

The present invention relates to a radiofrequency resonant circuit sensing device, a method of its production, and use thereof for a fluid sensing device for detecting a fluid in an article or a container; for containing a fluid, in particular a human or animal body fluid; and use thereof for radiofrequency resonant circuit tags in detection of theft of articles for sale.

The Technical Field

Generally, radiofrequency resonant circuit devices comprise layered structures of electrically conducting means comprising inductive and capacitive elements, and electrically insulating means separating the electrically conductive layers which are electrically connected through separate perforations of the electrically insulating layers.

Prior art radiofrequency resonant circuit devices include conductive paths that are etched out of various strong metal foils which are laminated on both sides of a flexible insulating carrier foil. Conductive connections are established by through-contacts through the foil which is a rather time consuming process. Further, through-contacts cannot be imprinted because this would damage the layers.

sensor of the fluid and the detection electronics are typically interconnected by electrically conducting connectors e.g. wires or cables, or by optical wave guides such as optical fibres. However, such connections can be sensitive to damage and for patients or elderly confined to a bed they can be very inconvenient and put severe constraints on their movability.

Particularly for patients or elderly who are able to walk around, such sensor-detector connections cannot be used without restricting their movability.

Since lack of movability of patients and elderly requires an increased level of monitoring of e.g. wounds and urinary and faecal incontinence by personnel, such a monitoring often being considered inconvenient and cumbersome, sensor-detector connections of monitoring devices implicitly contribute to bad sanitary conditions for patients and elderly and contaminated environments of wound healing sections, incontinence sections and the like of hospitals and nursery homes.

Wireless sensor-detector connection based on suitable receiver/transmitter electronics at the sensor and detection electronics can be contemplated. However, in order to function, such electronics requires a portable power supply such as an electric battery. This is impractical because of the necessary exchange or recharge of discharged batteries.

Consequently there is a need for wireless connection of fluid sensor and detection electronics which does not require portable power supply as well as sensors suited for sensing exposure of a fluid without requiring external power supply.

comprising a substrate, and first and second conductive pattern layers based on a polymeric binder and connected to form an inductive element and further connected to first and second capacitor electrodes having a dielectric film thereinbetween; said layers being sequentially applied, cross-linked and bonded together and adhered onto the substrate. The conductive pattern layers are applied using screen-printing with conductive printable ink. The dielectric film is screen-printed using e.g. a UV curable dielectric medium. The first and second conductive layers are connected through contacts via perforations in the dielectric film, specifically provided by impressing a dowel at the point of connection.

US Patent No. 4 646 066 discloses an indicator device and method of measuring incremental environmental exposure of an environmental parameter; said method comprising measuring responses of a target to an electromagnetic interrogation signal; said target including a tuned circuit and an element that is sensitive to environmental exposure, especially exposure to specified fluids e.g. liquids and water vapour, influencing the electronic or ionic conductivity. There is no teaching of parameter influences including the capacitance of the tuned circuit, nor of a measuring method based on changes of transmission of electromagnetic energy of oscillators transmitting electromagnetic energy to the tuned circuits.

2. DISCLOSURE OF THE INVENTION

Object of the Invention

It is an object of the present invention to provide a radiofrequency resonant circuit device which avoids

(a) a substrate having a surface;

(b) a layered structure comprising:

(i) at least one first electrically conducting means comprising an inductance (L);

(ii) at least one second electrically conducting means; and

(iii) at least one electrically insulating means which separates at least a part of said first electrically conducting means from said second electrically conducting means;

either of said at least one first or second electrically conducting means being positioned on said substrate;

the first and second electrically conducting means and the electrically insulating means being electrically connected to form a resonant circuit (LC);

wherein parts of the at least first and second electrically conducting means provide the electrodes of at least one capacitance (C), and

parts of said first and second electrically conducting means provide at least one connection between the first and second electrically conducting means, and

a sensing means for sensing a change of resonance conditions of the resonant circuit,

whereby the feature of providing at least one connection between the first and second electrically conducting

any of the parameters inductance, capacitance, and resistance, or a combination thereof.

In a preferred embodiment the at least one first electrically conducting means comprises an inductive element having a coil with separated windings for receiving a fluid,

whereby the fluid may short cut the windings and change the resonance conditions.

In order to further improve the ability of the resonant circuit sensing device to sense a fluid, either the inductive element, the capacitive element, the substrate, or a combination of these can be made particular attractive to the fluid, e.g. by coating thereof with a hydrophilic material.

In a preferred embodiment the substrate is attractive to said fluid,

whereby in an embodiment of the resonant circuit having the induction element positioned on the substrate, the windings of the coil are more likely to get into contact with the fluid. If the fluid is water or urine, it may short cut the windings and deactivate the resonant circuit.

Accordingly, in a preferred embodiment, the resonant circuit is deactivated by presence of a fluid.

Some applications do not allow the influence of a fluid, e.g. water, which could produce unintended signals, e.g. in theft security systems.

either of said at least one first or second electrically conducting means being positioned on said substrate;

the first and second electrically conducting means and the electrically insulating means being electrically connected to form a resonant circuit (LC);

wherein parts of the at least first and second electrically conducting means are provided with electrodes of at least one capacitance (C), and

(c) bringing parts of said first and second electrically conducting means to provide at least one connection between the first and second electrically conducting means,

whereby a very cost-effective method of mass-production of resonant circuits allowing use of printing techniques such as screen-printing is provided.

According to the invention it surprisingly turns out that electrically conducting connectors between cheap, mass produced sensing devices of fluid and the detection electronics, and battery power supply of the sensor, and receiver circuits for receiving and detecting responses of resonant circuits of the sensors can be avoided.

This provides a number of advantages e.g. that the sensor of the fluid can be separated from the detection electronics for detecting changes in the sensor. This is particularly advantageous when monitoring bodies containing fluid wherein the sensor and the detection electronics used cannot be connected permanently by electrically conducting connectors, or when they can only

Preferred articles include, but are not limited to, articles for containing or for taking up fluid or for delivering fluid; such container e.g. being monitored for being filled or being emptied.

In a preferred embodiment, the article consists of a hygienic article for healthy development and maintenance of health.

In a particularly preferred embodiment, the article consists of an absorbent or a bandage in form of a wrap or a trapping used to protect, cover or immobilise an injured or diseased part of a human or an animal, or used during surgery.

In a particularly preferred embodiment, the article consists of an absorbent for urine or faeces, in particular a diaper.

"Use of articles comprising the sensing device"

Articles comprising a sensing device according to the present invention are preferably used in a method of monitoring hygienic conditions of one or more patients; said method comprising applying one or more hygienic articles according to the invention to one or more patients, each article having a sensing device with a resonant circuit that differ from each other; and transmitting electromagnetic energy to said resonant circuits.

In an embodiment, the method further comprises monitoring at least one response of said resonant circuits, thereby allowing the prior art techniques of interrogating the resonant circuit to be used.

By contact of the resonant circuit with the fluid, one or more of the characteristics resistance R, capacitance C and inductance L, or any derivative thereof, e.g. the resonance frequency $\omega_0=(LC)^{-\frac{1}{2}}$, or higher harmonics thereof, or the quality factor $Q=\omega L/R$, e.g. at resonance $\omega=\omega_0$, change.

When one or more of the characteristics change, the ability of the resonant circuit to receive electromagnetic energy changes. This can be detected by detecting changes in one or more characteristics of one or more oscillators transmitting electromagnetic energy to said resonant circuit.

Generally, sensing devices can be manufactured in any suitable way that allow the external parameters to affect the impedance of the respective resonant circuits.

In the particular aspect of the invention relating to detecting a fluid, resonant circuits can be prepared in any suitable way that ensures the penetration of fluid into the resonant circuit to such an extent that one or more of its characteristics are changed.

In the particular aspect of the method of detecting a fluid, the change of characteristics of the resonant circuit causes a detectable change in one or more of the characteristics of the one or more oscillators.

In a preferred embodiment, the resonant circuit consists of a coil having separated windings which can receive the fluid and short cut the circuit.

The windings can be of any suitable material. In a preferred embodiment, the windings are made of an electrically conducting material selected from the group

a sticker, to be attached on a desired location, e.g. onto said container or diaper.

Several resonant circuits can be positioned in one location to encode for given patterns of frequencies, e.g. several small resonant circuits of e.g. different frequencies placed in a diaper can provide a unique identification of e.g. individual patients or elderly being monitored in a hospital or a nursing home.

In a particular aspect the present invention relates to a sensing device for sensing a fluid as claimed in claim 46 that can be mass produced by a printing process or a dispensing process.

A sensing device according to the invention has a number of advantages.

It can be produced by an application process such as a printing process or a dispensing process comprising a series of steps providing a layered structure of the first electrical conducting means, the electrical insulating means, and the second electrical conducting means. Printing or dispensing of suitable electrical conducting materials and electrical insulating materials, respectively, allows very fast and easily controllable production processes to be used.

A particular advantage is obtained, compared to prior art productions techniques of prior art resonant circuits using e.g. copper or tin as the electrical conducting means, in that a flexible resonant circuit can be produced. This is important for many applications wherein the resonant circuit is to be applied on or embedded in a carrier, e.g. a diaper, which can be bent and possible folded.

material onto the first electrical conducting means covering all or parts thereof, e.g. leaving parts for connecting points and areas to be exposed to the fluid during operation of the sensing device uncovered.

In a preferred embodiment, the application process is a printing process such as stencil printing and/or a dispensing process.

The term "dispensing" is intended to mean that a material, here a suitable electrical conducting material or a suitable insulating material which as dispensable, is applied to a substrate material by a suitable application means, including but not limited to application of a continuous fluid of the material, and application of droplets of the material by spraying.

Oscillators

According to the invention an oscillator operates in functional proximity of a resonant circuit.

In the present context the expression "functional proximity of a resonant circuit" is intended to mean that an oscillator in one location radiates electromagnetic energy, e.g. in form of radiowaves or microwaves, which can be fully or partly transferred to a resonant circuit in another location.

Generally, any suitable oscillator can be used, i.e. an oscillator which is able to produce electromagnetic oscillations and to emit electromagnetic energy e.g. in form of radiowaves or microwaves which is fully or partly received by the resonant circuit.

In another preferred embodiment, the oscillators comprise one or more antennas whereby the direction of the electromagnetic radiation, e.g. radio waves, can be more accurately defined. An antenna can be any suitable antenna known in the art, e.g. a dipole. In a preferred embodiment, the antenna comprises a radiator element, transmission lines, and optional transformers, coupled to the inductor, or constituting a part of the inductor.

Detectors

The apparatus further comprises one or more detectors for detecting one or more changes in one or more characteristics of said oscillators upon changes in the characteristics of one or more resonant circuits.

The characteristics of the oscillators comprise any suitable characteristic.

In a preferred embodiment the characteristics of the oscillator comprise current, voltage, or a derivative thereof such as power, whereby one or more characteristics, or derivatives thereof, of the resonant circuit are detected, e.g. change in frequency, particularly the resonance frequency; change in quality factor; and wholly or partial suppression or restoration of any of these.

In a preferred embodiment one or more of the detectors detect an increase or a decrease of energy loss of one or more of the oscillators.

Further, preferred embodiments of the invention and uses appear from the following detailed description and claims.

FIGS. 14, 15, and 16A and 16B show different embodiments of applications of the resonant circuit; and

FIGS. 17A and 17B and FIGS. 18A and 18B show applications of the resonant circuit inside and outside a collection bag and an infusion bag, respectively.

4. DETAILED DESCRIPTION

Embodiment of sensing devices according to the invention

FIGS. 1A and 1B show a preferred embodiment of a sensing device for sensing a fluid according to the invention.

It comprises a substrate having a surface, here exemplified by a flexible material 10 such as paper, textile, plastic, etc. in the form of e.g. a sheet or a foil.

On its surface opposite to the layered structure, or on any other suitable position, the substrate can have an adhesive layer whereby the sensing device can be adhered to the surface of e.g. a diaper, like a sticker, a label or a tag.

At least one first electrical conducting means comprising an inductance (L), here exemplified by a winding or a coil 12 of a conducting polymer such as an electrical conducting silicone of Wacker Silicones e.g. Semicosil 970 from Wacker-Chemie, and typically in form of a flat winding but not limited thereto, which inductance is positioned on the substrate surface, and parts thereof 11, here exemplified by a first extended conductor which provides a first electrode of at least one capacitance (C) and parts thereof, here a connecting point 15 which

resistor is considered to lie within the capabilities of those skilled in the art.

It should be noted that the term "being positioned on the surface of said substrate" is intended to include any such positioning wherein the material of the at least one first or second electrical conducting means penetrates wholly or partly into the substrate.

Principle of Design

The method of manufacturing a response circuit provided by the present invention enables an extensive range of options of size and arrangement of device. The invention allows a range of printing techniques to be applied in the method including continuously rotating printing methods for printing the conductive and dielectric patterns.

Generally, there is no requirement for a separate mechanical or other process for making the connection between the individual conductive layers. The design enables the printing process itself to connect the two conductive layers at the required position.

The design minimizes the size of the capacitor dielectric which is only printed where layers need to be separated.

Many conductive layers may be printed on top of each other using simple printing techniques without recourse to secondary processes for completing the device.

FIGS. 2A-2C and 3A-3C show a preferred embodiment of a method for the production of a sensing device according to the invention.

resonant circuits, e.g. including two capacitances C_1 and C_2, can be provided. The substrate is not shown.

The first electrical conducting means includes two extended conductors 11A, 11B, and two connecting points 15A, 15B (FIG. 4A). The two extended conductors are then covered by respective electrical insulating layers 14A, 14B (FIG. 4B). Finally, the second electrical conducting means in form of two extended conductors 13A, 13B are applied on the electrical insulating layers.

Examples of suitable application apparatus to be used in carrying out the method of producing a sensing device according to the invention are screen printers and stencil printers from e.g. EKRA, Eduard kraft GmbH Maschinen Fabrik, Bönnigheim, Germany. Specific apparatus can be mentioned e.g. E1™ Semi-automative Screen Printer and M2™ Semi-automatic Thick-Film Screen Printer, the latter being particularly suited for printing of solder pastes, through-hole coating using vacuum techniques, and multilayer systems. Further suitable apparatus are dispensing apparatus from e.g. Asymtek.

FIGS. 5A-5C show an application of the sensing device wherein fluid droplets affects the resonant circuit without penetrating therethrough (FIG. 5A), and with penetration (FIG. 5B). FIG. 5C provides a top view.

FIGS. 6-8 illustrate that more resonant circuits can be produced in parallel.

FIGS. 7A-7C and 8A-8C are similar to FIGS. 2A-2C and 3A-3C.

FIGS. 6A-6C illustrate production of resonant circuits 13 in parallel process lines on a single continuous foil 10.

water absorbents and water repellent front cover foils. At E, individual sections are punched out.

In another application, the same set up can be used to produce resonant circuit tags for theft security of sales products, in such products the resonant circuit is usually laminated with water repellent foils.

FIG. 10B illustrates perforations 101 in the foil 10 for controlling the movement thereof.

FIG. 11 illustrates the production of resonant circuits using a single step application apparatus 112 of pairs of resonant circuits B,C according to the invention wherein the conductive layers, here connecting points 11, are brought into contact with each other by folding the substrate about the folding line A by means of folding guide 110. Between the parts to be folded against each other there is inserted an insulating intermediate layer 111.

An antenna 61 and control unit 62 are positioned of the folding step and function to control the folding process in providing the desired contact between the two conductors.

In an embodiment, curement of the conductive UV-curable layers is obtained by UV-irradiation of the folded foil with the connecting points of the conductive paths in contact thereby providing fixed contacts.

In another embodiment, not shown, the connecting point 11 is placed closer to the folding line thereby providing a hinge-type contact which is useful in applications where the intermediate layer is constituted by available capacitive element e.g. a plastic bag. The hinge-type

FIG. 16A shows an attachable resonant circuit 80 of the type shown in FIG. 15 wherein the resonant circuit is embedded between a carrier material wholly or partly covered with adhesive, e.g. a skin compatible adhesive, material 81 for affixing the resonant circuit to e.g. the skin, or a diaper, and a releasable cover material 82 covering said adhesive properties thereof before use. It should be noted that the resonant circuit can be of the laminated type, or it can be directly adhered to or incorporated in the carrier material.

FIG. 16B shows several attachable resonant circuits 80 similar to that of FIG. 16A provided on an "endless" releasably cover material 81, particularly useful for fast and easy handling and application of many sensing devices, e.g. fluid, to a human body or an article, e.g. a diaper.

FIGS. 17A and 17B with cross sectional views show application of a fluid sensing device, i.e. a resonant circuit 91 e.g. of the type shown in FIG. 5C or FIG. 15, contained in a container 92, e.g. a collection bag, or drain bag, for monitoring the level of the collected fluid, e.g. drain fluid 12. The characteristics of the resonant circuit are changed upon contact with the fluid, see FIG. 17B.

FIGS. 18A and 18B show another application of a resonant circuit 101, e.g. of the type which can be used in combination with a hinge-type resonant circuit according to an embodiment discussed with respect to FIG. 11, attached to the outside of a container 102, e.g. an infusion bag, at the fluid level A-A for monitoring the level of a fluid 12 contained therein, when the level of the fluid sinks below the level A-A, the ability of the resonant circuit to receive electromagnetic energy from

RADIOFREQUENCY RESONANT CIRCUIT SENSING DEVICE, METHOD OF ITS PRODUCTION, AND USES

CLAIMS

1. A radiofrequency resonant circuit sensing device comprising

(a) a substrate (10) having a surface;

(b) a layered structure comprising:

(i) at least one first electrically conducting means (11,12) comprising an inductance (L);

(ii) at least one second electrically conducting means (13); and

(iii) at least one electrically insulating means (14) which separates at least a part of said first electrically conducting means from said second electrically conducting means;

either of said at least one first or second electrically conducting means being positioned on said substrate;

the first and second electrically conducting means and the electrically insulating means being electrically connected to form a resonant circuit (LC);

wherein parts (11,13) of the at least first and second electrically conducting means provide the electrodes of at least one capacitance (C), and

8. A device according to claims 1-7 wherein the resonant circuit is deactivated by presence of a fluid.

9. A device according to claims 1-8 wherein the resonant circuit further comprises a fuse.

10. A method of producing a resonant circuit sensing device comprising

(a) providing a substrate (10) having a surface;

(b) providing a layered structure comprising:

(i) at least one first electrically conducting means (11,12) comprising an inductance (L);

(ii) at least one second electrically conducting means (13); and

(iii) at least one electrically insulating means (14) which separates at least a part of said first electrically conducting means from said second electrically conducting means;

either of said at least one first or second electrically conducting means being positioned on said substrate;

the first and second electrically conducting means and the electrically insulating means being electrically connected to form a resonant circuit (LC);

16. An apparatus for detecting a fluid comprising: one or more oscillators (10) for transmitting electro-magnetic energy; one or more resonant circuits (11) for receiving electromagnetic energy from said oscillators; and one or more detectors for detecting changes in one or more characteristics of the one or more oscillators upon changes in characteristics of the resonant circuits by contact thereof with the fluid wherein the resonant circuit is according to claims 1-9.

17. Apparatus according to claim 16, wherein the one or more resonant circuits comprise coils having separated windings for receiving the fluid and short cut the circuit.

18. Apparatus according to claims 16 or 17, wherein the windings are made of an electrically conducting material selected from the group consisting of electrically conducting polymers such as polyaniline; or electrically conducting polymer blends such as blends of poly(p-phenylene vinylene), polyacrylamide, polyaniline and polyethylene.

19. Apparatus according to claims 16-18, wherein the one or more resonant circuits are contained in or attached onto one or more containers.

20. Apparatus according to claims 16-19, wherein the one or more resonant circuits are embedded in a diaper.

21. Apparatus according to claims 16-20, wherein the one or more resonant circuits are embedded in a carrier with an adhesive such as a sticker.

32. A sensing device according to claims 29-31, wherein said capacitance is constituted by a pair of electrodes and a spacer means.

33. A sensing device according to claim 32, wherein said spacer means is a variable distance between said pair of electrodes.

34. A sensing device according to claim 33, wherein said spacer means is an absorber.

35. A sensing device according to claims 29-31, wherein said at least two parts of the substrate are brought in a mutual overlaying relationship by folding.

36. A sensing device according to claims 29-31 comprising an electromagnetic antenna.

37. A sensing device according to claim 36, wherein said inductance provides said antenna.

38. The sensing device according to claims 29-37 wherein the sensing means is constituted by said first electrical conducting means, said second electrical conducting means, said at least one capacitance, alone or in combinations thereof.

39. Device according to claims 29-37, wherein the one or more resonant circuits consist of coils having separated windings for receiving the fluid and short cut the circuit.

40. A method of producing a sensing device for sensing a fluid; said method comprising providing a sensing device as claimed in claim 30, wherein the at least one electrically conducting means is provided on or embedded

the method as claimed in claims 40-45, for containing or for taking up or for delivering of fluid.

48. An article comprising a sensing device as claimed in claims 29-37, or a sensing device produced according to the method as claimed in claims 40-45, for healthy development and maintenance of health.

49. An article according to claim 48 consisting of an absorbent or a bandage in form of a wrap or a trapping used to protect, cover or immobilise an injured or diseased part of a human or an animal, or used during surgery.

50. An article according to claim 48 consisting of an absorbent for urine or faeces, in particular a diaper.

51. A method of monitoring hygienic conditions of one or more patients; said method comprising applying one or more articles according to claims 47-50 to one or more patients, each article having a sensing device with a resonant circuit which differs from those of the other articles; and transmitting electromagnetic energy to said resonant circuits.

52. A method according to claim 51, further comprising monitoring at least one response of said resonant circuits.

53. A method according to claims 51 or 52, further comprising monitoring changes of the transmission of electromagnetic energy of one or more oscillators transmitting electromagnetic energy to said resonant circuits.

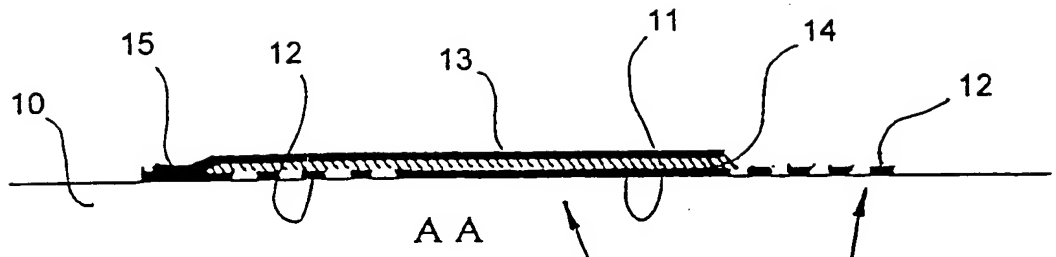

Fig. 1A

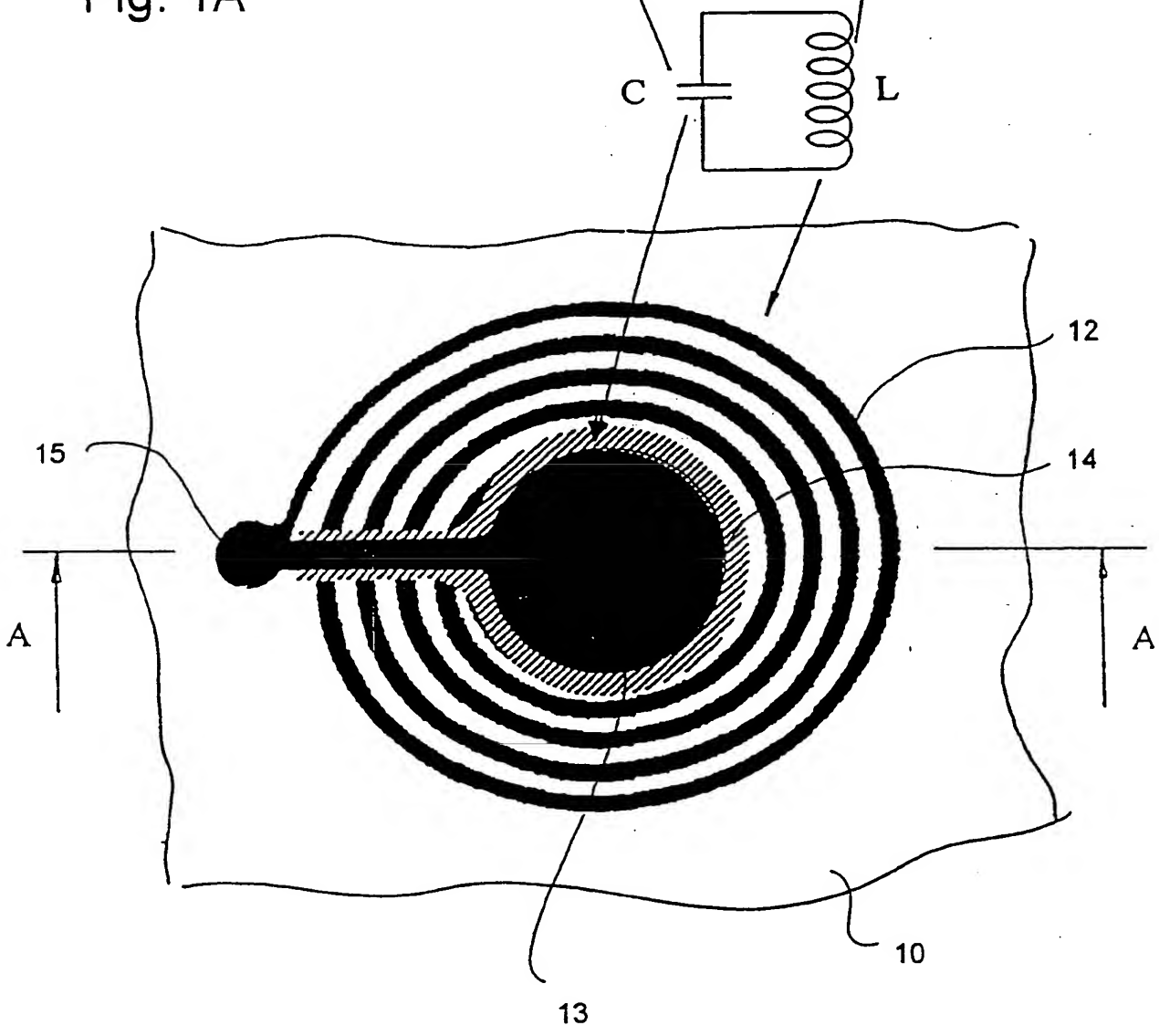

Fig. 1B

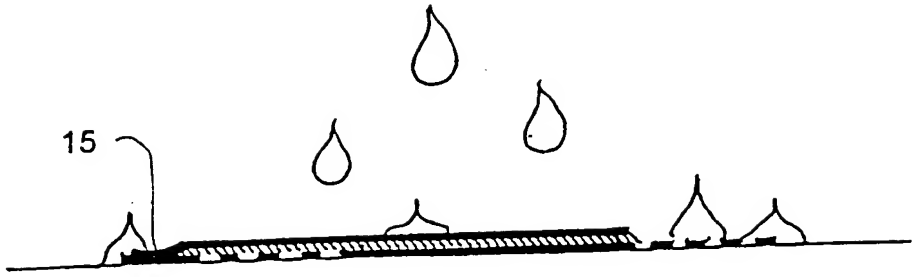

Fig. 5A

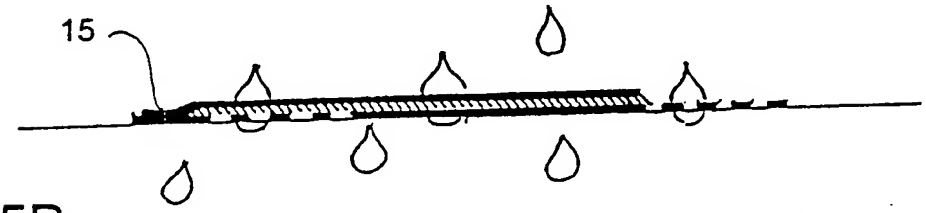

Fig. 5B

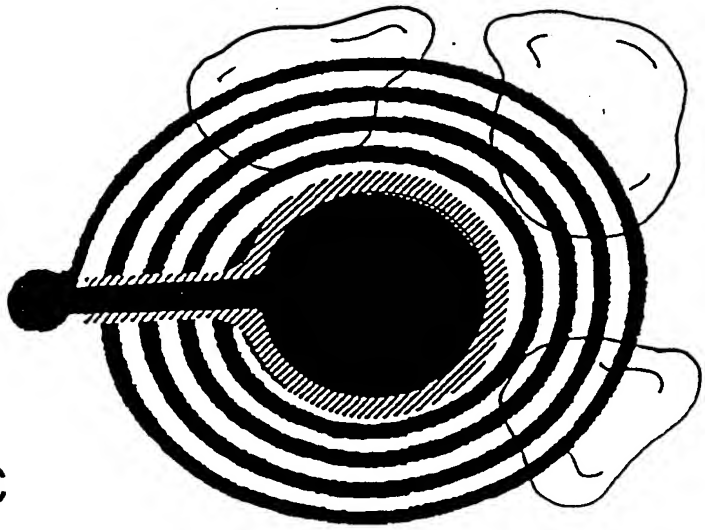

Fig. 5C

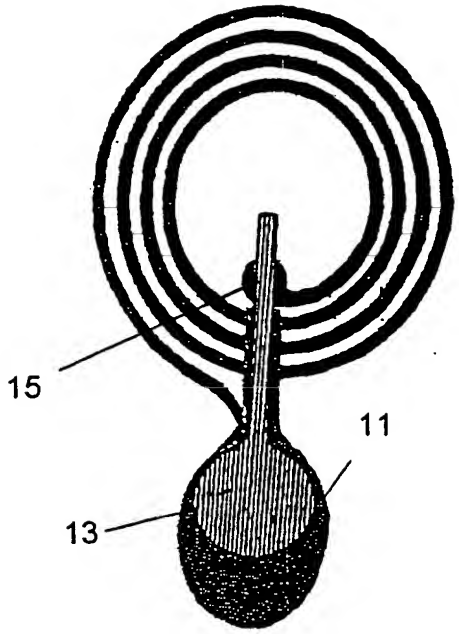

Fig. 9A

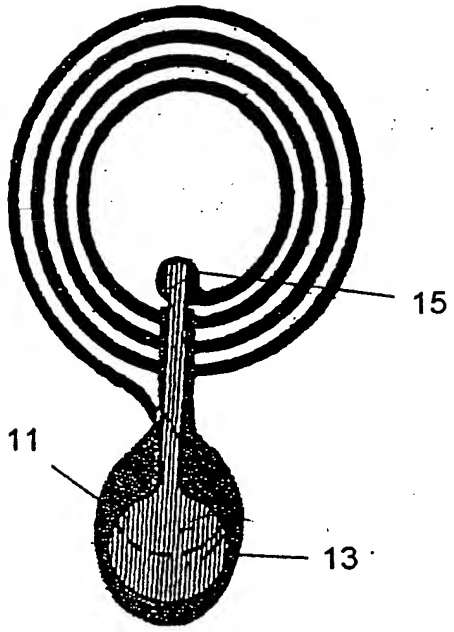

Fig. 9B

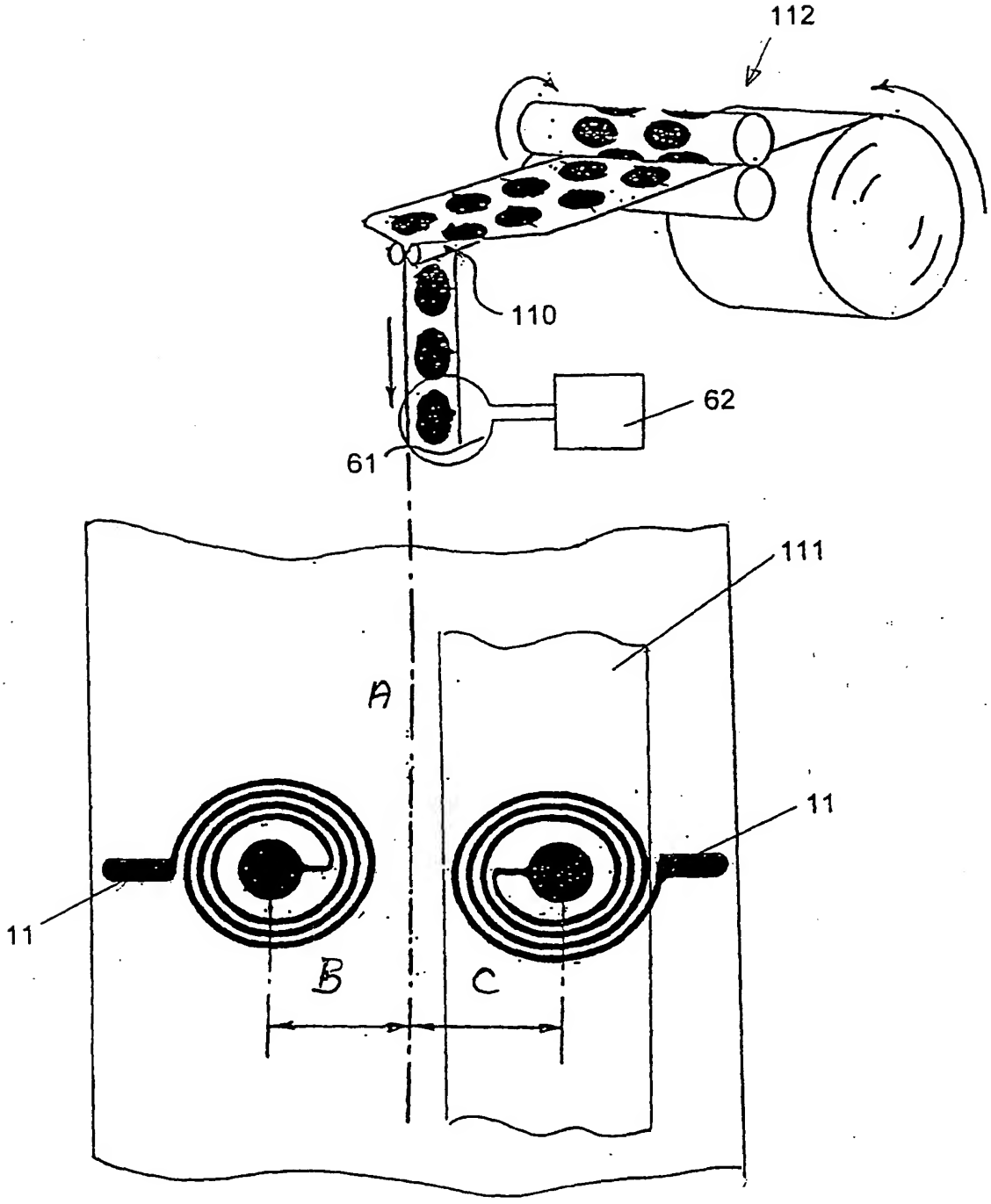

Fig. 11

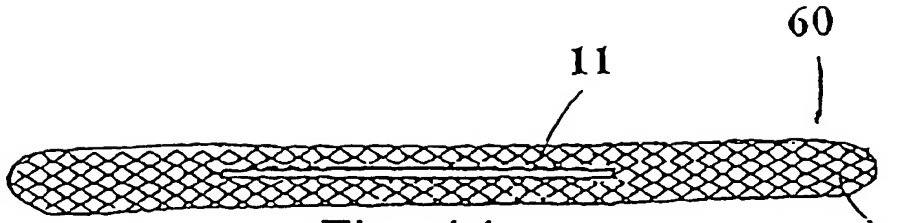

Fig. 14

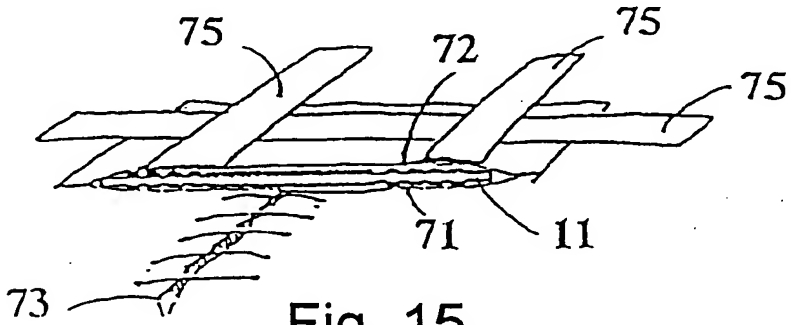

Fig. 15

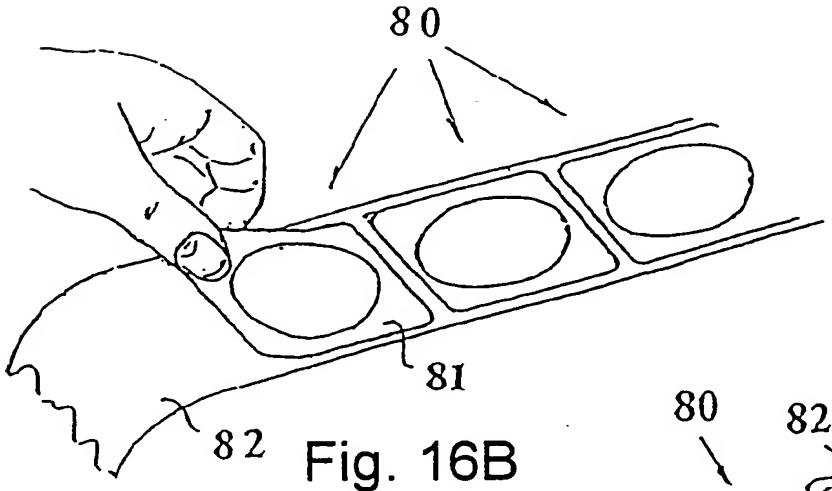

Fig. 16B

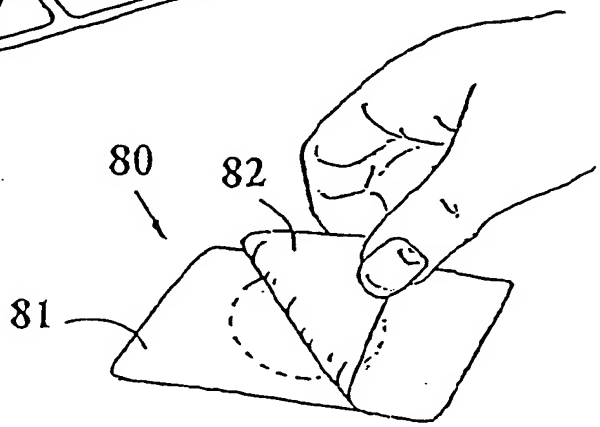

Fig. 16A

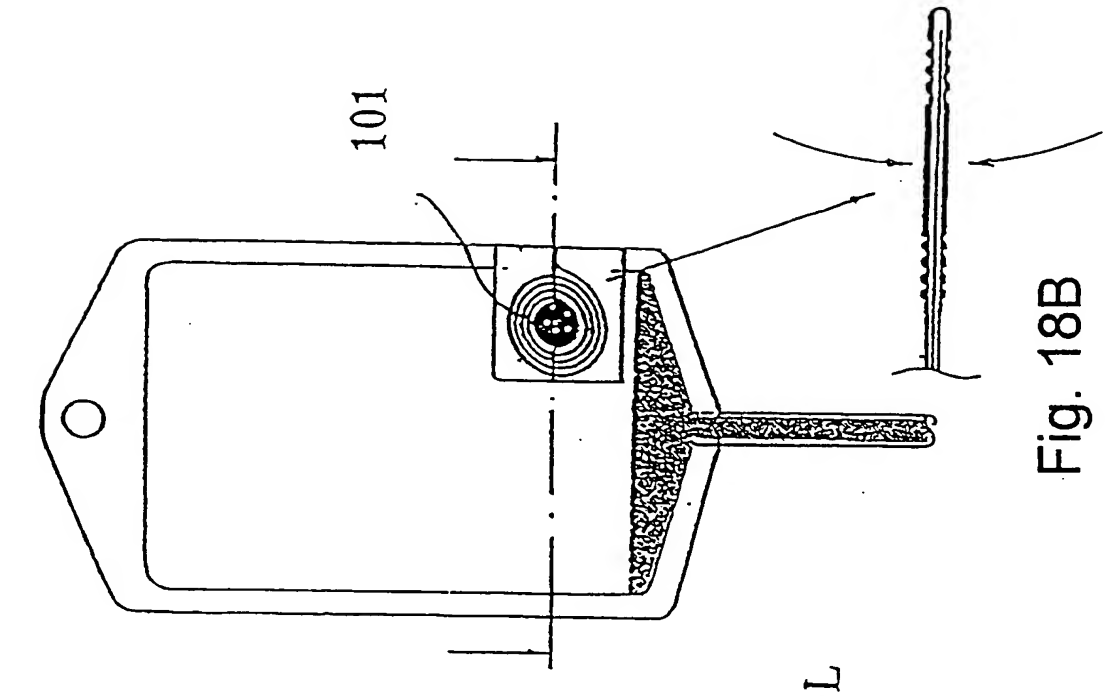

Fig. 18B

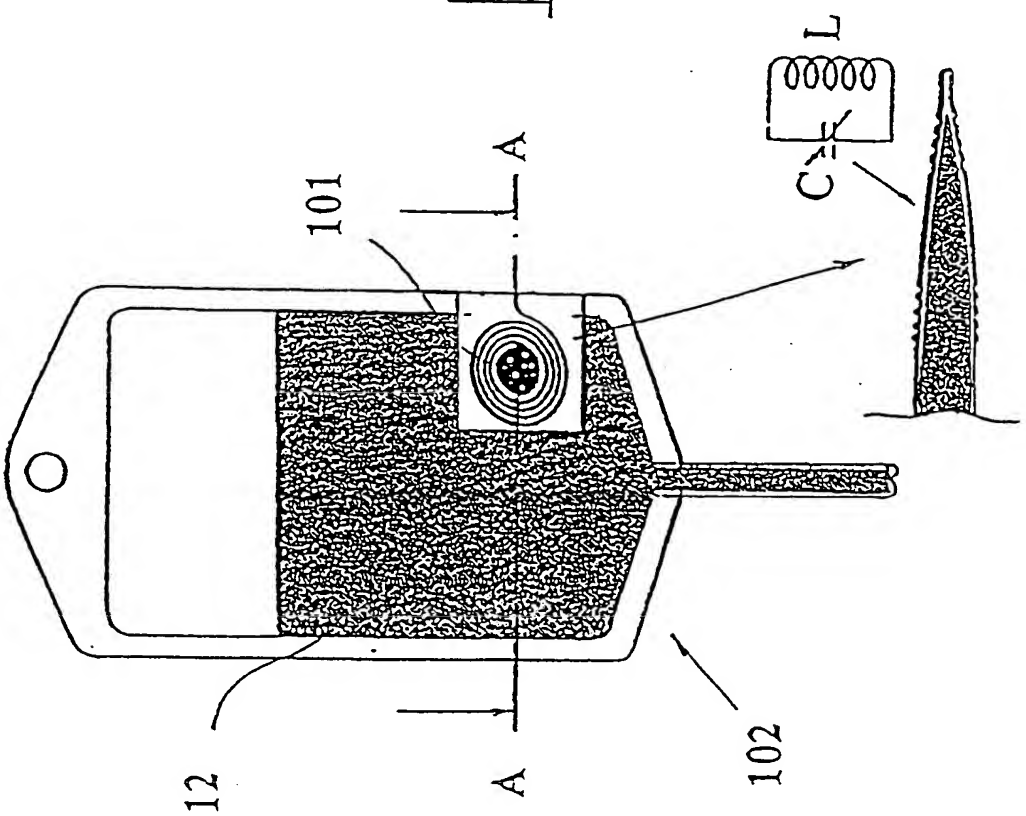

Fig. 18A

INTERNATIONAL SEARCH REPORT

International application No.
PCT/DK 00/00330

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4843404 A (S.E.BENGE ET AL), 27 July 1989 (27.07.89), figures 1-9, abstract	1-47,49-53
X		54
	--	
A	US 4578654 A (W.TAIT), 25 March 1986 (25.03.86), figure 1, abstract	1-47,49-53
X		54
	--	
P,A	WO 9933037 A1 (BENT THORNING BENSEN A/S), 1 July 1999 (01.07.99), abstract	1-47,49-54
	--	

Claim 48 defines an article or sensing device for healthy development and maintenance of health. No special features are defined that provide this capability.

According to PCT/Guidlines/2/chapter 3.7 no special efforts need be made for searching unduly wide or speculative claims, beyond the extent to which they are supported by the description.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/DK 00/00330

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4578654 A	25/03/86	AU 572226 B	05/05/88
		AU 3549184 A	23/05/85
		CA 1227259 A	22/09/87
		DE 3481457 D	00/00/00
		DK 163151 B,C	27/01/92
		DK 540584 A	17/05/85
		EP 0142380 A,B	22/05/85
		US 4598276 A	01/07/86
WO 9933037 A1	01/07/99	AU 1752199 A	12/07/99